

WHAT IS CLAIMED IS:

1. A microarray comprising a support having attached to a surface thereof at least one porous layer, wherein said porous layer comprises a hydrophilic binder and polymer particles.

2. The microarray of Claim 1 wherein said polymer particles comprise one or more polymers.

3. The microarray of Claim 1 wherein said polymer particles comprise water insoluble synthetic polymers.

4. The microarray of Claim 3 wherein said water insoluble synthetic polymers comprise at least one member selected from the group consisting of addition polymers, poly (alkylene oxides), phenol-formaldehyde polymers, urea-formaldehyde polymers and condensation polymers consisting of one or more of the following repetitive units: esters, amides, imides, carbonates, urethanes, and ethers.

5. The microarray of Claim 1 wherein said polymer particles comprise monodisperse polymer particles.

6. The microarray of Claim 5 wherein said monodisperse polymer particles have a particle size distribution, wherein the coefficient of variation of said particle size distribution is less than 20%.

7. The microarray of Claim 5 wherein said monodisperse polymer particles have a particle size distribution, wherein the coefficient of said particle size distribution is less than 10%.

8. The microarray of claim 1 wherein said polymer particles comprise chemically active groups.

9. The microarray of Claim 8 wherein said specific functionalities comprise chemically active groups present on the surface of said polymer particles.

10. The microarray of Claim 8 wherein said chemically active groups comprise at least one member selected from the group consisting of thiols, primary amines, secondary amines, tertiary amines, quaternary ammoniums, phosphines, alcohols, carboxylic acids, primary or secondary amines, vinylsulfonyls, aldehydes, epoxies, hydrazides, succinimidyl esters, carbodiimides, maleimides, iodoacetyls, isocyanates, isothiocyanates, aziridines, or sulfonates.

11. The microarray of Claim 8 wherein said chemically active groups comprise at least one member selected from the groups consisting of carboxylic acids, primary amines, secondary amines, or carboxylic acids.

12. The microarray of Claim 8 wherein said chemically active groups comprise vinylsulfonyl units.

13. The microarray of Claim 8 wherein said specific functionalities comprise chemically active groups present on stabilizer polymers which are covalently grafted, chemisorbed, or physically adsorbed to the surface of said polymer particles.

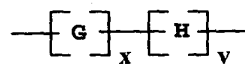
14. The microarray of Claim 13 wherein said stabilizer polymers comprise at least one member selected from the groups consisting of poly(propyleneimine), polymers and copolymers of methacrylic acid, acrylic acid, mercaptomethyl styrene, N-aminopropyl (meth)acrylamide and secondary amine derivatives thereof, N-aminoethyl (meth)acrylate and secondary amine forms

thereof, diallylamine, vinylbenzylamine, vinylamine, (meth)acrylic acid, vinylbenzyl mercaptan, and hydroxyethyl(meth)acrylate.

15. The microarray of Claim 13 wherein said stabilizer polymers comprise at least one member selected from the groups consisting of poly(vinylamine), poly(propyleneimine), polyethyleneimine, polyacrylic acid, polymethacrylic acid, or poly(N-aminopropyl methacrylamide).

16. The microarray of Claim 13 wherein said stabilizer polymers comprise pendant vinylsulfonyl or latent vinylsulfonyl groups.

17. The microarray of Claim 16 wherein said stabilizer polymers are represented by Formula I:



Formula I

wherein

“G” represents a polymerized α,β -ethylenically unsaturated addition polymerizeable monomer;

“H” represents a vinylsulfone or vinylsulfone precursor unit monomer; and

x and y both represent molar percentages ranging from 10 to 90 and 90 to 10.

18. The microarray of Claim 17 wherein x and y range from 25 to 75 and 75 to 25 respectively.

19. The microarray of Claim 17 wherein G represents nonionic or ionic monomers.

20. The microarray of Claim 19 wherein said ionic monomers comprise at least one member selected from the group consisting of 2-phosphatoethyl acrylate potassium salt, 3-phosphatopropyl methacrylate ammonium salt, acrylamide, methacrylamides, maleic acid and salts thereof, sulfopropyl acrylate and methacrylate, acrylic and methacrylic acids and salts thereof, N-vinylpyrrolidone, acrylic and methacrylic esters of alkylphosphonates, styrenics, acrylic and methacrylic monomers containing amine ammonium functionalities, styrenesulfonic acid and salts thereof, acrylic and methacrylic esters of alkylsulfonates, vinylsulfonic acid and salts thereof.

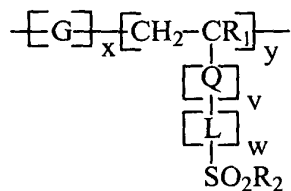
21. The microarray of Claim 19 wherein said nonionic monomers comprise at least one member selected from the group consisting of poly(ethylene oxide) segments, carbohydrates, amines, amides, alcohols, polyols, nitrogen-containing heterocycles, and oligopeptides.

22. The microarray of Claim 19 wherein said nonionic monomers comprise at least one member selected from the group consisting of poly(ethylene oxide) acrylate and methacrylate esters, vinylpyridines, hydroxyethyl acrylate, glycerol acrylate and methacrylate esters, (meth)acrylamide, and N-vinylpyrrolidone.

23. The microarray of Claim 17 wherein G represents the polymerized form of acrylamide, sodium 2-acrylamido-2-methanepropionate, sulfopropyl acrylate and methacrylate salts, or sodium styrenesulfonate.

24. The microarray of Claim 17 wherein H represents the polymerized form of a vinylsulfone or vinylsulfone precursor unit.

25. The microarray of Claim 17 wherein said "H" represents groups represented by Formula II:



Formula II

wherein:

R₁ is a hydrogen atom or a C₁-C₆ alkyl group. Preferably R₁ is a hydrogen atom.

Q is -CO₂-, or CONR₁-;

v is 1 or 0;

w is 1-3;

L is a divalent linking group containing at least one linkage selected from the group consisting of -CO₂- and -CONR₁, and containing 3-15 carbon atoms, or a divalent atom containing at least one linkage selected from the group consisting of -O-, -N(R₁)-, -CO-, -SO-, -SO₂-, -SO₃-, -SO₂N(R₁)-, -N(R₁)CON(R₁)- and -N(R₁)CO₂-, and containing 1-12 carbon atoms in which R₁ has the same meaning as defined above;

R₂ is -CH=CH₂ or -CH₂-CH₂X₁ wherein X₁ is a substituent replaceable by a nucleophilic group or releasable in the form of HX₁ by a base.

26. The microarray of Claim 25 wherein X₁ represents -S₂O₃⁻, -SO₄⁻, -Cl, -Br, -I, quaternary ammonium, pyridinium, and -CN, and sulfonate esters.

27. The microarray of Claim 1 wherein said polymer particles comprise at least one ethylenically unsaturated polymerizable monomer.

28. The microarray of Claim 27 wherein said at least one ethylenically unsaturated polymerizable monomer comprises at least one member selected from the group consisting of methacrylic acid esters, such as methyl methacrylate, ethyl methacrylate, isobutyl methacrylate, 2-ethylhexyl

methacrylate, benzyl methacrylate, phenoxyethyl methacrylate, cyclohexyl methacrylate and glycidyl methacrylate, acrylate esters such as methyl acrylate, ethyl acrylate, isobutyl acrylate, 2-ethylhexyl acrylate, benzyl methacrylate, phenoxyethyl acrylate, cyclohexyl acrylate, and glycidyl acrylate, styrenics such as styrene, α -methylstyrene, 3- and 4-chloromethylstyrene, halogen-substituted styrenes, and alkyl-substituted styrenes, vinyl halides and vinylidene halides, N-alkylated acrylamides and methacrylamides, vinyl esters such as vinyl acetate and vinyl benzoate, vinyl ether, allyl alcohol and its ethers and esters, and unsaturated ketones and aldehydes such as acrolein and methyl vinyl ketone, isoprene, butadiene and acrylonitrile. Preferably, the monomers will be styrenics or acrylic esters or methacrylic esters.

29. The microarray of Claim 27 wherein said at least one ethylenically unsaturated polymerizable monomer comprises chemical functionalities.

30. The microarray of Claim 29 wherein said chemical functionalities comprise at least one member selected from the group consisting of vinyl groups, acrylates, methacrylates, vinyl ethers and vinyl esters.

31. The microarray of Claim 27 wherein said at least one ethylenically unsaturated polymerizable monomer comprises trimethylolpropane triacrylate, ethylene glycol dimethacrylate, isomers of divinylbenzene, and ethylene glycol divinyl ether.

32. The microarray of Claim 27 further comprising one or more water-soluble ethylenically unsaturated monomers, wherein said one or more water-soluble ethylenically unsaturated monomers comprises less than 20% of the total weight of said polymer particles.

33. The microarray of Claim 32 wherein said one or more water-soluble ethylenically unsaturated monomers comprise at least one member selected from the groups consisting of styrenics, acrylates, and methacrylates substituted with highly polar groups, unsaturated carbon and heteroatom acids such as acrylic acid, methacrylic acid, fumaric acid, maleic acid, itaconic acid, vinylsulfonic acid, vinylphosphonic acid, and their salts, vinylcarbazole, vinylimidazole, vinylpyrrolidone, and vinylpyridines.

34. The microarray of Claim 1 wherein said polymer particles have a mean diameter of from 0.05 to 50 microns.

35. The microarray of Claim 1 wherein said polymer particles have a mean diameter of from 0.50 to 5 microns.

36. The microarray of Claim 1 wherein said hydrophilic binder comprises at least one member selected from the groups consisting of gelatin, modified gelatin, water-soluble cellulose ethers, poly(n-isopropylacrylamide), polyvinylpyrrolidone and vinylpyrrolidone-containing copolymers, polyethyloxazoline and oxazoline-containing copolymers, imidazole-containing polymers, polyacrylamides and acrylamide-containing copolymers, poly(vinyl alcohol) and vinyl-alcohol-containing copolymers, poly(vinyl methyl ether), poly(vinyl ethyl ether), poly(ethylene oxide), acacia, alginic acid, bentonite, carbomer, carboxymethylcellulose sodium, cetostearyl alcohol, colloidal silicon dioxide, ethylcellulose, guar gum, hydroxyethylcellulose, hydroxypropyl cellulose, hydroxypropyl methylcellulose, magnesium aluminum silicate, maltodextrin, methylcellulose, povidone, propylene glycol alginate, sodium alginate, sodium starch glycolate, starch, tragacanth, xanthum gum, and mixtures thereof.

37. The microarray of claim 1 wherein said hydrophilic binder comprises gelatin.

38. The microarray of Claim 37 wherein said gelatin comprises alkali pretreated gelatin.

39. The microarray of claim 1 wherein said hydrophilic binder comprises chemically active groups rich in specific functionalities.

40. The microarray of Claim 39 wherein said specific functionalities comprise at least one member selected from the group consisting of thiols, primary amines, secondary amines, tertiary amines, phosphines, alcohols, carboxylic acids, vinylsulfonyls, aldehydes, epoxies, hydrazides, succinimidyl esters, carbodiimides, maleimides, iodoacetyls, isocyanates, isothiocyanates, or aziridines.

41. The microarray of Claim 39 wherein said specific functionalities comprise at least one member selected from the group consisting of primary or secondary amines or a vinylsulfonyl group.

42. The microarray of Claim 39 wherein said hydrophilic binder comprises at least one member selected from the group consisting of poly(propyleneimine), polymers and copolymers of N-aminopropyl (meth)acrylamide and secondary amine derivatives thereof, N-aminoethyl (meth)acrylate and secondary amine forms thereof, diallyamine, vinylbenzylamine, vinylamine, (meth)acrylic acid, vinylbenzyl mercaptan, and hydroxyethyl(meth)acrylate. Preferably, the polymer is poly(vinylamine), poly(propyleneimine), or poly(N-aminopropyl methacrylamide).

43. The microarray of claim 1 further comprising a bioaffinity tag bound to said at least one porous layer in a spatially addressable manner.

44. The microarray of claim 43 wherein said bioaffinity tag is bound to said hydrophilic binder of said at least one porous layer.

45. The microarray of claim 43 wherein said bioaffinity tag is bound to said polymer particle of said at least one porous layer.

46. The microarray of claim 43 wherein said bioaffinity tag is bound to said stabilizer polymer.

47. The microarray of claim 43 wherein said bioaffinity tag comprises at least one member selected from the group consisting of DNA, antibodies, antigens, proteins, enzymes, nucleic ligands, and polysaccharides.

48. The microarray of claim 1 wherein said at least one porous layer comprises from 0.25 to 250 microns in thickness.

49. The microarray of claim 1 wherein said at least one layer comprises more than a single layer to produce a three-dimensional array.

50. The microarray of Claim 1 wherein said porous layer may also include crosslinking agents.

51. The microarray of claim 1 wherein said support comprises glass.

52. The microarray of Claim 1 wherein said support comprises at least one member selected from the group consisting of glass, fused silica, plastics, metals, papers and semiconductors.

53. The microarray of Claim 1 further comprising an under-coating or subbing layer between said porous layer and said support.

54. A method of using a microarray comprising:

providing a microarray comprising a support having attached to a surface thereof at least one porous layer, wherein said porous layer comprises a hydrophilic binder and polymer particles;

contacting said microarray with biological targets labeled with optical emission tag; and

measuring the signals from said optical emission tag.